

IN THE SPECIFICATION

Please replace the paragraph beginning at page 3, line 8 through line 12, with the following paragraph:

--Another object of the present invention is to provide a diagnostic information presenting apparatus, a diagnostic information display system, and a diagnostic information presenting method for a construction machine, which can reduce operator's fatigue or mechanic's fatigue.--

Please replace the paragraph beginning at page 8, line 18 through line 25, with the following paragraph:

-- According to a fourth invention, in the above second or third invention, ~~i.e., in the diagnostic information presenting apparatus for the construction machine according to Claim 2 or 3,~~ the control means outputs, to the display means, a reproduction display signal to reproduce and display changes of the status variable data which are stored in the first or second storage means and are within the predetermined time.--

Please replace the paragraph beginning at page 11, line 11 through line 16 with the following paragraph:

-- According to a ninth invention, in the above seventh or eighth invention, the control means outputs, to the display means, a reproduction display signal to

reproduce and display changes of the status variable data which are stored in the first or second storage means and are within the predetermined time.--

Please replace the paragraph beginning at page 13, line 5 through line 10, with the following paragraph:

-- According to a fourteenth invention, in the above twelfth or thirteenth invention, the method further comprises the step of outputting, to the display means, a reproduction display signal to reproduce and display changes of the status variable data which are stored in the first or second storage means and are within the predetermined time.--

Please replace the paragraph beginning at page 17, line 24 through page 18, line 9 with the following paragraph:

-- While the hydraulic excavator 1 is shown in Fig. 1, by way of example, as the so-called super-large-sized excavator (backhoe type) of a class having the body weight of several hundreds tons, which is employed in, e.g., oversea-mines or quarry sites in many cases, applications of the present invention are not limited to that class of excavators. In other words, the present invention is also applicable to the so-called large- or medium-sized excavator of a class having the body weight of several tens tons (such as shown in Figs. 2 and 3 described later), which is most popularly employed in various construction work sites or quarry sites, etc. ~~in Japan~~, and to the so-called mini-excavator of an even smaller class which is employed in small-scaled work sites.--

Please replace the paragraph beginning at page 18, line 23 through page 19, line 8, with the following paragraph:

-- The hydraulic pumps 21a, 21b are driven for rotation by two diesel engines 32 (only one is shown; hereinafter also referred to simply as an "engine 32") each provided with a fuel injecting device (not shown) of the so-called electronic governor type, and deliver a hydraulic fluid. The control valves (regulation valves) 22a, 22b - 26a, 26b control respective flows (flow rates and flowing directions) of the hydraulic fluid supplied from the hydraulic pumps 21a, 21b to the hydraulic actuators 27 - 31a, 31b, and the hydraulic actuators 27 - 31a, 31b drive the boom 16, the arm 17, the bucket 18, the swing body 13, and the travel body 12. The hydraulic pumps ~~42a~~21a, 21b, the control valves 22a, 22b - 26a, 26b, and the engine 32 are mounted in an accommodation room (engine room) in a rear portion of the swing body 13.--

Please replace the paragraph beginning at page 24, line 19 through line 25, with the following paragraph:

-- In Fig. ~~56~~, the keypad 51 includes, as various operating buttons, a "O" button 51a, a "x" button 51b, a "*" button 51c, an upward cursor "↑" button 51d, a downward cursor "↓" button 51e, a leftward cursor "←" button 51f, a rightward cursor "→" button 51g, and a "?" button 51h. With any button touched by the operator's hand, a corresponding operation signal X is outputted to the controller 2.--

Please replace the paragraph beginning at page 27, line 18 through page 28 line 8, with the following paragraph:

-- The basic data display control unit 2B corresponds to the basic data display area 50A of the initial screen 100 on the display unit 50. Based on the detected signals of the engine revolution speeds, the detected signals of the radiator cooling water temperatures, the detected signals of the turbo-boosted pressures, the detected signal of the fuel level, the detected signal of the working oil temperature, the detected signal of the atmospheric temperature, and the detected signal of the battery voltage from the sensors 45, 46, 47b, 47c, etc., the control unit 2B outputs display signals (basic data display signals), which are used for presenting display corresponding to the respective detected status variable data (basic data), to the tachometer display areas 50Aa, 50Ad, the radiator cooling-water temperature display areas 50Ab, 50Ae, the turbo-boosted pressure display areas 50Ac, 50Af, the fuel level display area 50Ag, the working oil temperature display area 50Ah, the atmospheric temperature display area 50Ai, and the battery voltage display area 50Aj of the display unit 50.--

Please replace the paragraph beginning at page 28, line 9 through line 12 with the following paragraph:

-- The alarm display control unit 2C corresponds to the alarm display areas 50Ba, 50Bb of the initial screen 100 on the display unit 50, and it has the alarm on/off determining function and the alarm display signal producing function.--

Please replace the paragraph beginning at page 29, line 23 through page 30, line 1, with the following paragraph:

-- The alarm display signals from the alarm display signal producing function are also inputted to the screen display control unit 2G for presenting various kinds of display when the screen on the display unit 50 is shifted from the initial screen 100 to any of other screens subsequent to an alarm list display screen by operation of the operator (as described later).--

Please replace the paragraph beginning at page 30, line 7, through page 31, line 3 with the following paragraph:

-- The failure presence/absence determining function determines based on the detected signals (status variable data) from the sensors 40, etc. whether each detected signal indicates a failed state. As a manner of making the determination, the failed state is categorized into various types of failure modes given below:

~~(1) the case where the status variable data is itself normal (sensor is normal), but it shows a value unexpected for the relevant part of the hydraulic excavator 1 (i.e., the system is abnormal);~~

(21) the case where the status variable data is not stabilized and is unstable;

(32) the case where a voltage level of the detected signal is too high or short-circuited to the high voltage side;

(43) the case where a voltage level of the detected signal is too low or short-circuited to the low voltage side;

(54) the case where a current level of the detected signal is too low, or a circuit is left open;

(65) the case where a ~~voltage-current~~ level of the detected signal is too high or short-circuited to the ground side;

(76) the case where a mechanical response is improper (the difference between a target value and a measured value is too large); and

(87) the case where the frequency, the pulse width and/or the cycle is abnormal.--

Please replace the paragraph beginning at page 32, line 8 through line 14, with the following paragraph:

-- The failure display signals from the failure display signal producing function are also inputted to the screen display control unit 2G for presenting various kinds of display when the screen on the display unit 50 is shifted from the initial screen 100 to any of other screens subsequent to a failure list display screen by operation of the operator (as described later).--

Please replace the paragraph beginning at page 32, line 15 through page 33, line 4, with the following paragraph:

-- The screen display control unit 2G has the function of controlling layout of the entire screen on the display unit 50. More specifically, the screen display control unit 2G displays the entire layout of the initial screen 100 (i.e., frame and form portions except for the status variable data itself and the details of the alarm/failure display). Also, the control unit 2G outputs, to the display unit 50, the display control signals in accordance with the keypad operation signal X directly inputted from the

signal input processing unit 2A, a manual snapshot start command signal, an automatic snapshot start command signal, various display signals (described later) from the manual snapshot control unit 2E and the automatic snapshot control unit 2F, the alarm display signal from the alarm display control unit 2C, as well as the failure display signal from the failure display control unit 2D. Further, the control unit 2G displays the screen 100 while shifting the initial screen to another one in a switching manner.--

Please replace the paragraph beginning at page 33 line 26, through page 34, line 19, with the following paragraph:

-- When the operator operates the "←" button 51f of the keypad 51 in the state of the initial screen 100 being displayed, the corresponding keypad operation signal X is inputted from the signal input processing unit 2A to the screen display control unit 2G (this process is similarly applied to the button operation in the following description). Thus, the determination in step 20 is satisfied, whereupon display processing comes into the alarm-side screen shift mode and proceeds to step 30 for change to an alarm list (List-1) screen 101 on which a list of alarms occurred at that time are displayed (see Fig. 10). With the operation of the "↑" button 51d or the "↓" button 51e of the keypad 51, the cursor position in the screen 101 is moved upward or downward in the screen 101. If the operator operates the "×" button 51b of the keypad 51 at this time, the determination in step 40 is satisfied, whereupon the display processing returns to step 10 and the initial screen 100 is displayed (see Fig. 10). If the operator operates the "O" button 51a of the keypad 51 in the state of one

alarm being selected by the cursor, the determination in step 50 is satisfied subsequent to step 40, and the display processing proceeds to step 60.--

Please replace the paragraph beginning at page 35, line 11 through line 26, with the following paragraph:

-- In step 90, a circuit diagram screen 103 showing the occurrence location of the selected alarm is displayed (see Fig. 10). The screen 103 displays the alarm occurrence location, which is previously displayed in the location general drawing on the detailed information screen 102, on a circuit diagram (i.e., a diagram of a hydraulic circuit or an electric circuit) to more closely indicate the position where the alarm occurrence location exists in the circuit. Therefore, the operator can easily understand the position where the alarm occurrence location exists in the circuit, and how the alarm occurrence location is related to other locations in the functional point of view. If the operator operates the "x" button 51b of the keypad 51 at this time, the determination in step ~~70~~100 is satisfied, whereupon the display processing returns to step ~~40~~60 and the preceding detailed information screen 102 is displayed (see Fig. 10).--

Please replace the paragraph beginning at page 38, line 8 through line 16, with the following paragraph:

-- The intermediate processing unit 2Ea is to execute primary processing of the status variable data. More specifically, the intermediate processing unit 2Ea takes in all of the detected signals sent from the sensors 40, etc. (or from each unit

of sensor ~~loop-group~~ or each sub-controller as described above) at predetermined intervals via the signal input processing unit 2A. Then, it classifies and assorts the taken-in data per sensor (or per status variable), and loads and stores the data in a time-serial way.--

Please replace the paragraph beginning at page 40 line 16 through line 24, with the following paragraph:

-- The intermediate processing unit 2Fa is to execute primary processing of the status variable data. More specifically, the intermediate processing unit 2Fa takes in all of the detected signals sent from the sensors 40, etc. (or from each unit of sensor ~~loop-group~~ or each sub-controller as described above) at predetermined intervals via the signal input processing unit 2A. Then, it classifies and assorts the taken-in data per sensor (or per status variable), and loads and stores the data in a time-serial manner.--

Please replace the paragraph beginning at page 40, line 25 through page 41, line 9, with the following paragraph:

-- The automatic snapshot processing unit ~~2Eb~~2Fb includes a storage means capable of successively storing data (e.g., the so-called ring buffer that successively stores data while overwriting and updating data in units of a predetermined time). Then, it extracts and reads, from the intermediate processing unit ~~2Ea~~2Fa, the status variable data classified and loaded in the intermediate processing unit ~~2F~~2Fa, thereby preparing, overwriting and updating automatic snapshot primary data in a

successive way. In addition, the automatic snapshot processing unit 2Fb previously stores therein a map representing combinations of alarm/failure items and a plurality of corresponding status variables per item. Fig. 13 shows one example of the map.--

Please replace the paragraph beginning at page 41, line 10 through line 22, with the following paragraph:

-- In Fig. 13, the combinations are set, for example, such that when a "cooling water overheat alarm" is issued, the variables "atmospheric temperature", "cooling water temperature at upper manifold", "air temperature in front of radiator", "radiator outlet temperature", "inlet pressure of radiator cooler fan motor and ~~turbo-boosted pressure~~", "cooling water pump delivery pressure / upper manifold pressure", and "engine revolution speed" are collected as the corresponding status variables. The "cooling water pump delivery pressure / upper manifold pressure" can be obtained, for example, by detecting the respective pressures and then computing a ratio between the detected values in the controller 2.--

Please replace the paragraph beginning at page 41, line 23 through page 42, line 8, with the following paragraph:

-- The automatic snapshot processing unit 2Fb prepares, overwrites and updates the automatic snapshot primary data in a successive way while referring to the map. Then, when the alarm/failure display signal is inputted from the alarm display control unit 2C or the failure display control unit 2D, the automatic snapshot processing unit 2Fb extracts and reads, from the ring buffer or the like, those of the

automatic snapshot primary data stored in the ring buffer or the like, which fall within a predetermined time range on the basis of the input time of the alarm/failure display signal (e.g., 1 minute before the input time and 5 minutes after the input time), thereby preparing the automatic snapshot primary data (final data) ~~in accordance with the command.~~--

Please replace the paragraph beginning at page 42, line 18 through line 26 with the following paragraph:

-- The reproduction processing unit 2Fd extracts and reads, in accordance with a reproduction command signal (i.e., a command for selecting the alarm or the failure in ~~collection~~ reproduction of the automatic snapshot data as described in detail later) inputted from the keypad 51 via the signal input processing unit 2A, those of the automatic snapshot data corresponding to the command from the storage processing unit 2Fc, thereby reproducing a motion image (which may be a still image) of the automatic snapshot data (as described in detail later).--

Please replace the paragraph beginning at page 43, line 24 through page 44, line 3, with the following paragraph:

-- Fig. 17 shows the menu screen 110. As shown in Fig. 17, the menu screen ~~40-110~~ contains an "alarm/failure list" button 110a for displaying a list of current and past alarms/failures (after displaying the list, this button can further reproduce the automatic snapshot data), and a "monitoring and manual snapshot" button 110b for

~~displaying the list of current and past alarms/failures and executing the manual snapshot.--~~

Please replace the paragraph beginning at page 44, line 4 through line 11, with the following paragraph:

-- If the operator operates the "↑" or "↓" button 51d, 51e of the keypad 51 to select the item "monitoring and manual snapshot" button 110b and then operates the "O" button 51a of the keypad 51 in the state of the menu screen 110 being displayed, the determination in step 230 is satisfied, whereupon the display processing comes into the manual-snapshot-side screen shift mode and proceeds to step 240 for change to a snapshot item display screen (not shown).--

Please replace the paragraph beginning at page 46, line 6 through page 47 line 1, with the following paragraph:

-- In step 300, the reproduction processing unit 2Ed displays a motion image reproduction screen 112 on which the selected manual snapshot data is reproduced in the form of a motion image (see Fig. ~~44~~15). On the screen 112, numeral 112A represents an area for displaying the name of the manual snapshot item (such as "engine (1) output drop"), 112B represents an area for displaying changes of those of the corresponding status variable data within a certain period, which are indicated in ON/OFF fashion, and 112C represents an area for displaying changes of those of the corresponding status variable data within the period, which are indicated as physical quantities. In the area 112C, each of the physical quantities is displayed in

the form of a horizontally extending bar graph as shown, and changes of the physical quantity within the period are displayed through reproduction of a motion image in a visually clearly discernable way with continuous extension and contraction of the bar graph. On the right side of the bar graph, the name of the corresponding status variable (or sensor) is displayed. If the operator operates the "x" button 51b of the keypad 51 at this time, the determination in step 310 is satisfied, whereupon the display processing returns to step 280 and the preceding manual snapshot data list screen 111 is displayed (see Fig. 15).--

Please replace the paragraph beginning at page 47, line 2 through line 25 with the following paragraph:

-- On the other hand, if the operator operates the "alarm/failure list" button 110a in the state of the menu screen 110 being displayed, the determination in step 320 is satisfied, whereupon the display processing comes into the automatic-snapshot-side screen shift mode and proceeds to step 330 in which the screen display control unit 2G changes the screen, in accordance with the signals from the alarm display control unit 2C and the failure display control unit 2D, to an alarm/failure (= event) list screen 113 for displaying a list of the contents of alarms/failures occurred at the present and in the past (see Fig. 4-16). The screen 113 schematically displays the name of each alarm or failure and the date when the alarm or the failure occurred. Such display enables the operator to easily recognize what kinds of troubles have occurred in the relevant machine operated by himself (or the operator in the preceding working shift, etc.) up to now. With the operation of the

"↑" button 51d or the "↓" button 51e of the keypad 51, the cursor position in the screen 113 is moved upward or downward. Then, if the operator operates the "O" button 51a of the keypad 51 in the state of one item of the alarm or failure data being selected (see Fig. 16), the determination in step 340 is satisfied and the display processing proceeds to step 350.--

Please replace the paragraph beginning at page 47, line 26 through page 48 line 11, with the following paragraph:

-- In step 350, the screen display control unit 2G changes the screen to a detail display/reproduction selection screen 115 for prompting the operator to select a shift to a screen for displaying details of the selected alarm or failure or to a screen for reproducing the automatic snapshot data that has been already collected and stored at that time. With the operation of the "→" button 51g or the "leftward" button 51f of the keypad 51, a "detail" button or a "snapshot reproduction" button can be selected depending on the cursor position on the screen 115. If the operator operates the "O" button 51a of the keypad 51 in the state of the "detail" button being selected by the operator (i.e., on a screen 115b in Fig. 16), the determination in step 360 is satisfied and the display processing proceeds to step 370.--

Please replace the paragraph beginning at page 48, line 27 through page 49 line 11, with the following paragraph:

-- In step 400, a circuit diagram screen showing the occurrence location of the selected alarm or failure is displayed (though not shown). This screen is similar to

the above-described screen 103 and displays the alarm or failure occurrence location, which is previously displayed in the location general drawing on the detailed information screen, on a circuit diagram (i.e., a diagram of a hydraulic circuit or an electric circuit) to more closely indicate the position where the alarm occurrence location exists in the circuit. If the operator operates the "x" button 51b of the keypad 51 at this time, the determination in step ~~41~~410 is satisfied, whereupon the display processing returns to step 370 and the preceding screen 115 is displayed.

Please replace the paragraph beginning at page 49, line 18 through page 50, line 8, with the following paragraph:

-- In step 430, the reproduction processing unit 2Fd displays a motion image reproduction screen 116 on which the snapshot data having been already produced by the automatic snapshot processing unit ~~2Fd~~2Fb and stored in the storage processing unit 2Fc regarding the selected alarm or failure is reproduced in the form of a motion image (see Fig. 16). The screen 116 is similar to the manual snapshot motion image reproduction screen 112 described above, and has an area for displaying the name of the automatic snapshot item (such as "cooling water overheat alarm"), an area for displaying changes of those status variables within a certain period, which are indicated in ON/OFF fashion, and an area for displaying changes of those status variables within the period, which are indicated as physical quantities, in the form of bar graphs. If the operator operates the "x" button 51b of the keypad 51 at this time, the determination in step 440 is satisfied, whereupon the display

processing returns to step 350 and the preceding screen 115 is displayed (see Fig. 16).--